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Certified by

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PROVISIONAL APPLICATION FOR PATENT COVER SHEET

This is a request for filing a PROVISIONAL APPLICATION FOR PATENT under 37 CFR 1.53(c).

Express Mail Label No. EV 094 354 146 US

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Additional inventors are being named on the 1 *separately numbered sheets attached hereto*

TITLE OF THE INVENTION (500 characters max)

METHOD FOR LARGE LEAK TESTING

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ENCLOSED APPLICATION PARTS ***(check all that apply)***

[X] Specification *Number of Pages* 3 [ ] CD(s), Number ___

[X] Drawing(s) *Number of Sheets* 1 [X] Other (specify) Return Receipt Postcard

[ ] Application Data Sheet. See 37 CFR 1.76

METHOD OF PAYMENT OF FILING FEES FOR THIS PROVISIONAL APPLICATION FOR PATENT

[ ] Applicant claims small entity status. See 37 CFR 1.27.

[ ] A check or money order is enclosed to cover the filing fees.

[X] The Director is hereby authorized to charge filing fees or credit any overpayment to Deposit Account Number: 50-0895

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FILING FEE AMOUNT ($): $160

The invention was made by an agency of the United States Government or under a contract with an agency of the United States Government.

[X] No.

[ ] Yes, the name of the U.S. Government agency and the Government contract number are: ___

[Page 1 of 2]

Respectfully submitted,

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Date 6/11/03

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REGISTRATION NO. *(If appropriate)* 37,485

Docket Number: 03-18 US PRO

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USE ONLY FOR FILING A PROVISIONAL APPLICATION FOR PATENT

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PROVISIONAL APPLICATION COVER SHEET
Additional Page

Docket Number	03-18 US PRO

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Number 1 of 1

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Docket No.: 03-18 US PRO

VARIAN

METHOD FOR LARGE LEAK TESTING

DESCRIPTION OF THE INVENTION

This patent disclosure describes a new method for large (gross) leak testing using a new helium window concept. Present state of the art leak detectors utilize a turbomolecular pump, for example, to maintain vacuum in an analyzer as shown in Figure 1. The analyzer can be a mass spectrometer, RF quadrupole, or any other type of gas analysis device. Typically the leak detector contains a mechanical primary pump (4) that rough pumps the leak detector test line (2) and the test volume (11) from ambient pressure, and also backs the turbo pump (7). Helium that enters the test port inlet (1) from the test volume (11) flows in contraflow through the turbo pump and into the analyzer (8). The analyzer detects this helium and reports a helium leak rate. The permitted test line pressure is determined by the fore line capability of the turbo pump and is generally limited to a maximum pressure around 10 to 20 Torr. Further, a minimum vacuum pressure must be maintained in the analyzer for it to function properly.

For large (gross) leak testing, where the test port pressure could be greater than 20 Torr, a second mechanical pump (9) is required for present art leak detectors with a bypass tube (3) and a differential pressure aperture (10) such that most of the gas flows to the roughing pump (9) while a percentage of the gas flows to the primary pump (4) with helium going in contraflow through the turbo pump to the analyzer. By this method, gas can be sampled in the analyzer while maintaining an acceptable fore line vacuum pressure for the turbo pump and analyzer. Testing with two pumps and a differential pressure aperture is an inherently unreliable process since, for example, the aperture can become partially plugged by atmospheric contamination resulting in erroneous readings. Further, the cost of the second pump and associated hardware significantly increases cost.

The key feature is a window composed of a permeable material that selectively permeates helium. This could be, but not limited to, a polymer or a quartz material in any shape or form (sphere, cylinder, capillary, etc.). For applications where quartz is used, the quartz is heated by a heater, such as resistive, radiant, or other appropriate heat transfer means, to allow selective permeation of helium (hereafter called "window"). It is known that the permeation rate of helium

can be controlled by temperature to adjust the sensitivity of the window. This new helium window can bc used in a leak test system under vacuum, at ambient pressure, or at a slight over pressure. This invention uses this window and provides a more reliable, more accurate, and more cost effective method since the second pump, manifold, and aperture can be eliminated resulting in a more compact system configuration. The invention describes an accurate large (gross) leak test during the pump down time interval, without the need for a second rough pump and associated aperture.

Figure 2 shows the invention: a leak detector with a helium permeable window (3) installed in the test line (2) of the leak detector. When a quartz window is used, an electronic controller is required to control the window temperature (9). During the time interval while vacuum pump (4) begins to remove gas from the test volume (10), the window (3) permits helium from a leak to enter into the analyzer volume (8). The turbo pump (7) is of a hybrid configuration with both turbo blades and MacroTorr (drag) stages so that a high fore line pressure, 10 Torr or higher, is permitted. This pump (7), connected to its fore-line manifold (5), can maintain sufficient analyzer pressure for a substantial time period without the need of the backing pump (4). This design permits valve (11) to be closed during the initial pump down, isolating the analyzer vacuum from the roughing line vacuum. The only path for helium to flow from the rough line to the analyzer is through the permeable window. The permeable window, however, prevents other gases from entering the analyzer. In this way, as soon as the system begins pumping the test volume, leak testing can begin. In prior art devices, leak testing could not begin until a sufficient roughing line pressure was achieved for proper turbo pump and analyzer operation. This time-advantage is crucial for many applications in the industry. Further, if the vacuum pressure sensed in the analyzer becomes too high, the valve (11) will automatically open for a brief time period, and the roughing valve will close briefly, to reconnect the backing pump (4) to maintain operational conditions as needed.

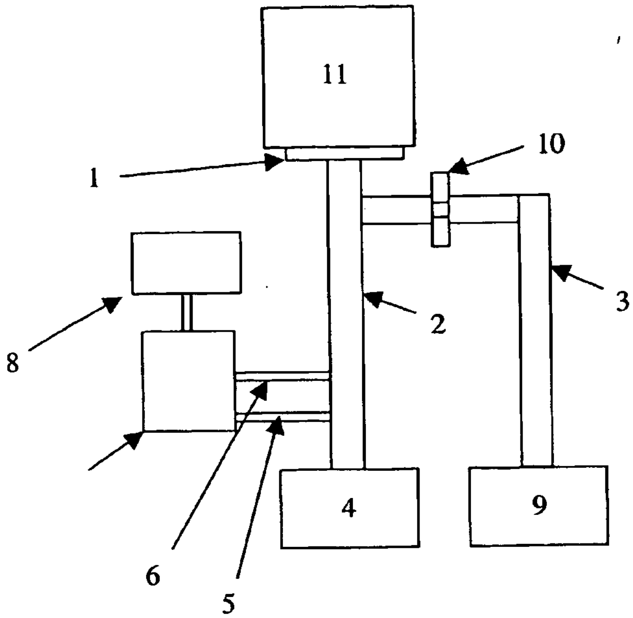
If after the initial gross leak testing no large leak is detected, the system continues to pump down, the window is bypassed, and the leak detector cycles to "contraflow" mode and then "midstage" mode. Using this method, only one primary pump (4) is required for both gross leak and fine leak testing.

<u>**SUMMARY OF THE INVENTION**</u>

1. A leak test device made of a suitable permeable material of any shape or form.
2. A heater (resistive, radiant, or similar technology) heats the quartz material to allow helium permeation, while selectively blocking most other gases, water, and dust. A heater is not required where a permeable polymer, for example is used.
3. When heated to a certain temperature, quartz material permeates helium at a constant rate.
4. The temperature can be adjusted to control the permeation rate and therefore the sensitivity.
5. The window can be installed at the inlet of an analyser such as a mass spectrometer assembly.
6. The helium, which permeated through the permeable window, can be detected by the analyzer and the signal can be converted to a leak measurement.
7. The window can operate either at vacuum, atmospheric pressure, or at a pressure slightly higher than atmospheric.
8. The window can operate in an atmosphere that contains various gases, particles such as dust, or in wet environments.
9. The helium window can be used to leak test in wet environments such as leak testing of (but not limited to) condensers in a power plant at the exhaust of a steam ejector pump.
10. The window allows for large leak detection in a helium leak detector with a single rotary evacuation backing/evacuation pump (not limited to a rotary van pump, but including any type of vacuum pump)

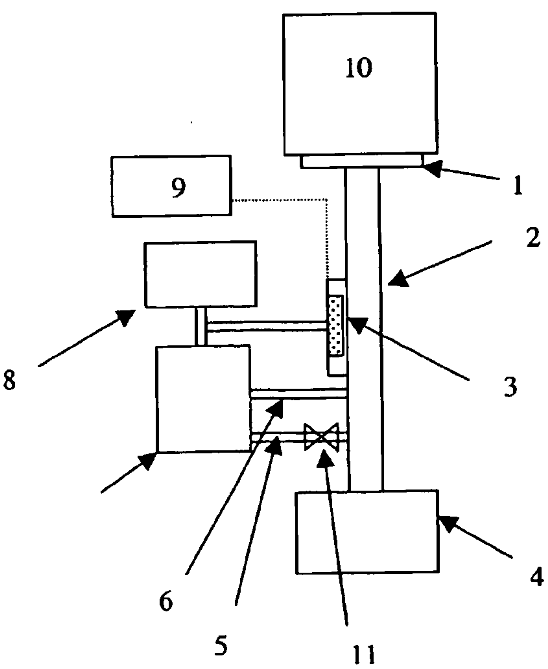
Docket No.: 03-18 US PRO

Figure 1 – Dual-Pump Leak Detector for Large Leak Testing



1 - Inlet flange
2 - Test line
3 - Roughing line
4 - Primary pump
5 - Fore line
6 - Midstage inlet line
7 - Turbo pump
8 - Analyzer
9 - Roughing pump
10 – Aperture
11 – Test volume

Figure 2 Single Pump Helium Leak Detector With Quartz Window For Large Leak Test



1 - Inlet flange
2 - Test line
3 - Helium window
4 - Primary pump
5 - Fore line
6 - Midstage inlet line
7 - Turbo pump
8 - Analyzer
9 - Electronic controller
10 - Test volume
11 – Forc line valve